PENGARUH SURFAKTAN CTMA-Br (Setiltrimetilamonium-Bromida) PADA SINTESIS LEMPUNG TERPILAR SiO_2/TiO_2 SERTA APLIKASINYA SEBAGAI FOTOKATALIS DEGRADASI *METANIL YELLOW*

Oleh :

Siwi Harning Pambudi
J2C003159

RINGKASAN

Telah dilakukan penelitian tentang pengaruh penambahan surfaktan CTMA-Br (setiltrimetilamonium-bromida) dengan memvariasi komposisi pada sintesis lempung terpilar silika (SiO_2) dari lempung alam Pontianak serta diuji aktivitas katalitiknya untuk fotokatalis degradasi *metanil yellow*. Variasi komposisi CTMA-Br dilakukan untuk mengetahui hubungan penambahan surfaktan CTMA-Br terhadap *basal spacing*, kristalinitas, luas permukaan spesifik, dan distribusi pori lempung terpilar silika yang dihasilkan. Titanium dioksida (TiO_2) merupakan senyawa semikonduktor yang telah digunakan sebagai katalis dalam proses degradasi senyawa berwarna. Pada penelitian ini lempung terpilar silika yang dihasilkan digunakan sebagai media pengemban untuk mendistribusikan katalis TiO_2.

Lempung terpilar silika (SiO_2) disintesis dengan melakukan pertukaran kation menggunakan surfaktan CTMA-Br (variasi komposisi) dan interkalasi TEOS (tetraetilortosilikat)-dodesilamin pada daerah antarlapis lempung serta kalsinasi lempung terinterkalasi TEOS pada temperatur 600 °C. Karakterisasi hasil meliputi *basal spacing* dan kristalinitas dengan menggunakan difraksi sinar-X, serta luas permukaan spesifik dan distribusi pori dengan menggunakan *Surface Area Analyzer* (metode BET). Selanjutnya lempung terpilar hasil sintesis diimpregnasi dengan titanium dioksida (TiO_2). Uji aktivitas katalitik lempung terpilar teremban TiO_2 dilakukan terhadap proses fotokatalis degradasi *metanil yellow*. Analisis hasil fotokatalis degradasi dilakukan dengan menggunakan spektrofotometer UV-Vis.

Lempung terpilar silika (SiO_2) yang dihasilkan dengan memvariasi komposisi surfaktan CTMA-Br mempunyai *basal spacing* semakin menurun, kristalinitas semakin meningkat, luas permukaan spesifik semakin menurun dan distribusi pori yang lebih merata dan ukurannya lebih seragam seiring dengan semakin banyak CTMA-Br yang ditambahkan. Aplikasi sebagai fotokatalis degradasi *metanil yellow* menunjukkan lempung terpilar silika (SiO_2) teremban TiO_2 mampu mendegradasi *metanil yellow*. Semakin banyak jumlah TiO_2 yang teremban dalam lempung terpilar silika, semakin besar aktivitas katalitiknya.

SUMMARY

A research on the effect of addition of CTMA-Br (cethylmethylammonium-bromide) surfactant on the synthesis of sillica pillared clay (SiO_2) from Pontianak natural clay had been done. The research was done by varying the composition of surfactant to find out the influence of CTMA-Br additon on the basal spacing, crystalinity, spesific surface area, and the pore distribution of the synthesized pillared clay. The clay was then tested for its catalytic activity in the photocatalysis of methanil yellow degradation. Titanium dioxide (TiO_2) is a semiconductor material which has been widely used as catalyst in coloring agent degradation. In this research, the produced sillica pillared clay was used as impregnated media to distribute TiO_2 catalyst.

Silica pillared clay (SiO_2) was synthesized by performing ion-exchange process using CTMA-Br surfactant, TEOS (tetraethylortosillicate)-dodecylamine intercalation on interlayer area of clay and calcination of TEOS-intercalated clay at 600°C. The characterization was carried out by analyzing the basal spacing and crystalinity of pillared clay by X-Ray Diffraction (XRD) and the specific surface area and pore distribution by surface area analyzer (BET method). The pillared clay was then impregnated by TiO_2. The catalytic activity of pillared clay impregnated TiO_2 was tested against the photocatalysis of methanil yellow degradation. The photocatalysis result was analyzed by UV-Vis spectrophotometer.

The research data showed that the basal spacing and the specific surface area of clay decreased as the addition of CTMA-Br increased. On the other hand, its crystalinity and pore distribution increased by the increasing of surfactant concentration. The application of pillared clay impregnated TiO_2 showed that it was able to decolorize methanil yellow. The more TiO_2 impregnated on the pillared clay, the greater its catalytic activity.

DAFTAR PUSTAKA

Ahenach, J., Cool, P.,dan Vansant E.F., 2000**,** *Enhanced Bronsted Acidity Created upon Al-grafting of Porous Clay Heterostructure Via Aluminium Acetylacetonate Adsorption*, Chem Phys, (2), 5750-5755.

Anonim, 2006, *Yellow No.406*, Japanese Society for Contact Dermatitis.

Ding, Z., Zhu, H.Y., Lu, G.Q., dan Greenfield, P.F., 1999, *Photocatalytic Properties of Titania Pillared Clays by Different Drying Methods*, J. Colloid and Interface Sci.209, 193-199.

Figuera, F., 1988, *Pillared Clay as Catalyst*, Catal. R*ev*. Sci. Eng, 30(3), 457-499.

Gillot, J. E., 1987, *Clay in Engineering Geology*, Elsevier.

Gunlazuardi, J., 2001, *Fotokatalisis pada Permukaan TiO_2: Aspek Fundamental dan Aplikasinya*, Seminar Nasional Kimia Fisika II, Jurusan Kimia, F.MIPA, Universitas Indonesia.

Gunlazuardi, J., dan Andayani, W., 2002, *Evaluasi Deklorinasi dan Pemecahan Cincin Aromatis selama Degradasi Pentaklorofenol Secara Fotokatalisis pada Permukaan Lapisan Tipis Titanium Dioksida*, Prosiding Seminar Nasional Himpunan Kimia Indonesia, UPI Bandung.

Han, Y., Matsumoto H., dan Yamanaka S., 1997, *Preparation of New Silica Sol-Based Pillared Clay with High Surface Area and High Thermal Stability*, Chem Matter, 2013-2018.

Isminingsih, R., 1973, *Pengantar Kimia Zat Warna*, ITT, Bandung, hal: 76-79.

Kansal, S.K., Singh M., dan Sudo D., 2006, *Studies on Photodegradation of Two Commercial Dyes in Aqueous Phase Using Different Photocatalysts*, J. Hazardous Materials, In Press.

Komariyah, N., 2005, *Sintesis Katalis Lempung Terpilar SiO_2/Ni dan Pemanfaatannya dalam Hidrorengkah Minyak Bumi*, Skripsi, Jurusan Kimia FMIPA Undip, Semarang.

Kwon, Hak-Sik, dan Sang, 2000, *Preparation of Porous Silica Pillared Layered Phase: Simultaneous Intercalation of Amine-Tetraethylorthosilicate into the H^+-Magadiite and Intragallery Amine-Catalyzed Hydrolisys of Tetraethylorthosilicate*, Chem Matter, (12), 1273-1278.

Kwon, Park, dan Jeong, 2001, *Preparation of Porous Silica-Pillared Montmorillonite: Simultaneous Intercalation of Amine-Tetraethylorthosilicate into H-Montmorillonite and Intra-Gallery Amine-Catalyzed Hydrolysis of Tetraethylorthosilicate*, Bull. Korean Chem. Soc., 22(7), 678-684.

Maes, N., Heyley I., Cool P., dan Vasant E.F., 1997, *The Relation Between The Synthesis of Pillared Clays and Their Resulting Porosity*, Applied Clay Science. Elsevier Science, p. 43-59

Murtado, H., 1994, *Kajian Reaksi Pertukaran Ion Kalsium oleh Ion Natrium pada Bentonit Alam*, Skripsi, FMIPA UGM, Yogyakarta.

Ogawa, M. dan Kuroda, K., 1997, *Preparation of Inorganic Nanocomposites through Intercalation of Organoammonium Ions into Layered Silicates*, Bull. Chem. Soc. Jpn., 70, 2593-2618.

Ohtsuka, K., 1997, *Preparation and Properties of Two-Dimensional Microporous Pillared Interlayered Solid*, Chem Matter, 2039-2050.

Polverejan, M., Pauly, T.R., dan Pinnavaia, T.J., 2000, *Acidic Porous Clay Heterostucture (PCH): Intragallery Assembly of Mesoporous Silica in Synthetic Saponite Clay*, Chem Matter, (12), 2698-2704.

Rashed, M.N. dan El-Amin A.A., 2007, *Photocatalytic Degradation of Methyl Orange in Aqueous Under Different Solar Irradiation Sources*, J. Of Physical Sciences Vol. 2 (3), Pp. 073-081.

Renita, M., Rosdanelli, H., dan Irvan, 2004, *Perombakan Zat Warna Azo Reaktif secara Aerob dan Anaerob*, Fakultas Teknik Jurusan Teknik Kimia, Universitas Sumatera Utara.

Subramani, A.K., Byrappa, K., Ananda, S., Lokanatha Ray, K.M., Ranganathaiah, C., dan Yoshimura, M., 2007, *Photocatalytic Degradation of Indigo Carmine Dye Using TiO_2 Impregnated Activated Carbon*, Bull.Mater.Sci, vol.31, Indian Academy of Sciences, pp 37-41.

Tan, K.H., 1991, *Dasar-Dasar Kimia Tanah*, a.b: Goenadi, D.H., Gadjah Mada University Press, Yogyakarta, hal: 45-165.

Vansant, E.F dan Cool. P., 1997, *Pillared Clay*: *Preparation, Characterization and Application*, Chem Matter, 265-286.

Zhu, H. Y. dan Lu, G. Q., 2001, *Engineering the Structures of Nanoporous Clays with Micelles of Alkyl Polyether Surfactants*, Langmuir, 17, 588-594.